Yggdrasil LGX: Linux/GNU/X

The Yggdrasil Linux/GNU/X-Windows Operating System
Fall 1993
For ISA-based or EISA-based PC Compatibles
Includes complete source code!

The 56,027 files in this complete plug-and-play operating system include:

- Linux 0.99.13 kernel (see back for hardware compatibility),
- an easy-to-use installation script,
- a simple "fill in the blanks" graphical system configuration control panel,
- *The X Window System:* version 11 release 5 (see hardware list on back), Xlib/Xt X windows libraries, the Tcl/Tk scripting language, the Xview 3.0 OpenLook(tm) toolkit, InterViews 3.1 C++ toolkit,
- The Andrew System version 5.1, including the ez editor for easy creation and reading of documents with imbedded images, equations, spreadsheets, hypertext links, and many other media types.
- *Ethernet Networking* with TCP/IP, NFS and other Internet protocols.
- Games: asteroids, battle zone, chess, mille bornes, othello, pool, shogi, solitaire, tetris, and connect four.
- *Multimedia:* viewers for JPEG, GIF, TIFF and other image formats, MPEG video, sound,
- *Text editors:* the elvis vi clone, GNU Emacs with calc mode, and Lucid GNU Emacs (better graphical user interface).
- *Desktop Publishing:* TEX and groff typesetting packages with X previewers, and ghostscript, a postscript interpreter for X windows, faxes and a variety of printers,
- *Telecommunications:* kermit, Z-modem, Taylor UUCP, mail reader, threaded USENET News reader, with support for reading MIME multimedia messages with imbedded images, full motion video and sound.
- the Postgres 4.1 remote database system,
- *Programming Languages:* GNU C++, GNU ANSI C, FORTRAN-to-C and Pascal-to-C translators, and Prolog,
- *Development tools:* GNU debugger, bison, flex, GNU make, the GNU Coverage Tool, Revision Controls System, Concurrent Version System, and Gnats,
- System V-style shared memory and interprocess communication,
- *File Systems:* a filesystem with long file names, symbolic links, and FIFO's, iso9660+rockridge CDROM filesystem, DOS filesystem, Xenix filesystem,
- *Emulators:* BIOS emulator for running DOS, experimental ELF loader, snapshot of a WABI Windows emulator under development.

Yggdrasil LGX: Fall 1993

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1 About This Manual

This manual will guide you through the installation of the Yggdrasil LGX (Linux/GNU/X-Windows) Operating System on your computer and how to access the online documentation on the CDROM. The online documentation explains how to configure and use the many software packages that comprise this distribution.

If you are new to unix-like systems, you may want to pick up a copy of *Unix For People*, available from Lurnix (Berkeley, California). For books on specific software facilities, check out the *Nutshell* series of books, printed by O'Reilly and Associates. In addition, you may want to buy some of the manauls printed by the Free Software Foundation (Cambridge, Massachusetts). However, you do not need these manuals or even this manual to run LGX. The system is designed to be sufficiently straightforward to use so that if you just plug it and reboot your machine, you should be able to find what you need just by exploring.

With this manual, you should have received a copy of the Fall 1993 LGX CDROM and either a 3.5" or a 5.25" boot floppy, or possibly both. Generally, these items are bound to the inside back cover of the manual. If you have not received these items, take this book back to where you bought it.

2 Installation

2.1 Instructions For The Impatient

Go for it! Insert the CDROM and the boot floppy, and reset your computer. LGX will run directly from the CDROM and the boot floppy.

After the operating system boots, you will see a page describing some useful user names that have been installed. You may want to explore the system by trying these different user names. As long as you don't do anything that writes to your hard disk, it is essentially impossible to do anything that would harm your computer or your copy of LGX, since neither the CDROM nor the floppy disk is writable.

The built-in user name `install` is a for the installation program, which provides a page or more of detailed instructions for every step of the installation process.

2.2 Booting the CDROM

After inserting the CDROM and the boot floppy and resetting your computer, the first message that you see should be '`Boot:`'. Do not type anything at this point. Instead, after a brief interval the boot loader will automatically load a kernel from the floppy disk which will eventually mount the CDROM. Your screen should look something like this:

```
 ---------------------------------------------------------------------
|                                                                     |
| System Configuration  (C)  Copyright 1985-1991, Megatrends Inc.,    |
|---------------------------------------------------------------------|
| Main Processor     : 80486          | Base Memory Size    : 640 KB    |
| Numeric Processor  : Present        | Ext. Memory Size    : 7424 KB   |
| Floppy Drive A:    : 1.2MB, 5.25'' | Hard disk C: type   : None      |
| Floppy Drive B:    : None           | Hard disk D: type   : None      |
| Display Type       : VGA/PGA/EGA    | Serial Port(s)      : 3F8       |
| ROM BIOS Date      : 07/07/91       | Parallel Ports(s)   : 378       |
|-------------------------------------|-------------------------------|

256KB CACHE MEMORY

Boot:

LILO Loading linux_
```

If you had typed something else at the '`Boot:`' prompt, you would have been able to tell the boot loader to boot one of your other disk partitions,

such as a DOS or OS/2 partition, instead of the floppy. If you accidentally typed something, you can delete the characters that you typed with the BACKSPACE key, and then make the boot loader continue with its default behavior by just hitting RETURN to the 'Boot:' prompt.

2.3 Watching LILO load the kernel

'LILO' is the name of the boot loader. Different phases of the boot loader print each of the four letters in L I L O, so you can actually monitor the phases of the loading process as the loader's name is spelled out.

The LILO boot loader will load and start the Linux kernel. One of the first things that the Linux kernel does when it starts is to attempt to detect what kind of hardware you have in your machine. If you ever think that the kernel is not talking to a particular device on your system, one of the first things that you should do is check the boot message to see if the kernel notices anything anomolous about your system's configuration or if it is not recognizing the device at all, perhaps due to an IRQ conflict.

You should see messages like the following when the kernel is detecting your hardware configuration. Probably you will see a few more messages than this, because this particular screen was derived from a machine with very little hardware in it.

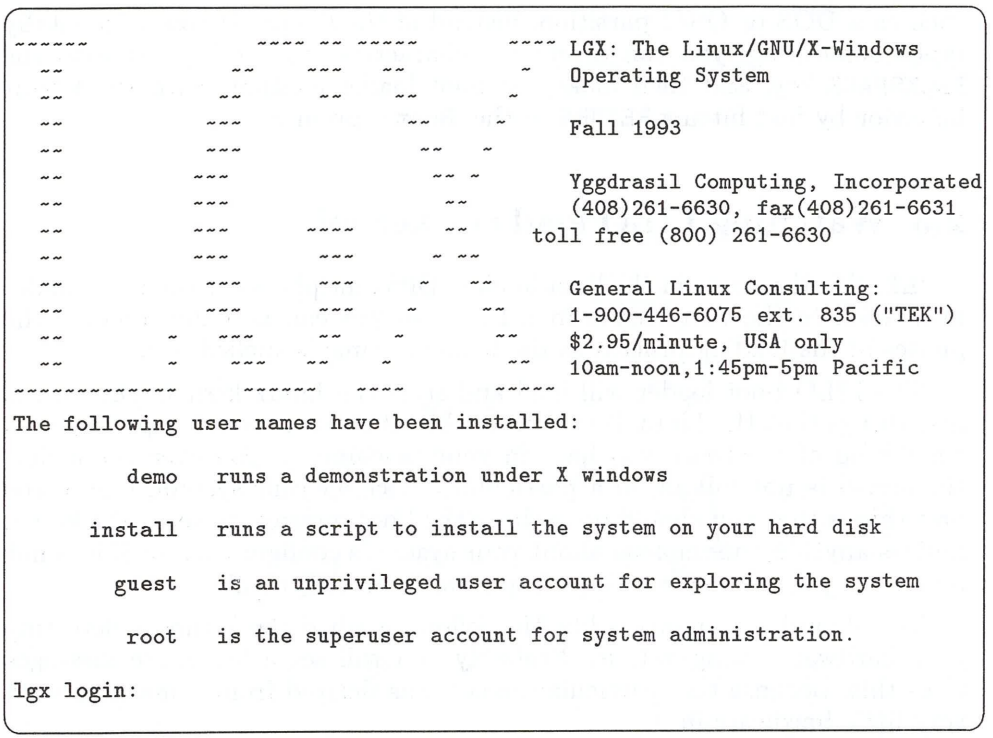
```
Uncompressing Linux...done.

Now booting the kernel.



LILO Loading linux
Console: colour PVGA/VGA/EGA+ (80x24), 8 virtual consoles
Serial driver version 3.96 with no serial options enabled
tty0 at 0x3f8 (irq = 4) is a 16450
lp_init: lp1 exists (0) using polling driver
scsi: detected 0 SCSI disks 0 tapes and 0 CD-ROM drives total
Memory: 6068k/8448k available (672k kernel code, 384k reserved, 132k data)
plip.c: v0.04 Mar 19 1993 Donald Becker (becker@super.org)
plip0: Using parallel port at 0x3bc at IRQ 5
plip1: Using parallel port at 0x378 at IRQ 7
plip2: Using parallel port at 0x278 at IRQ 2
8390.c: v0.99-10 5/28/93 for 0.99.6+ by Donald Becker (becker@super.org)
dl0: D-Link Pocket adapter -- probe failed at 0x378.
```

If everything is more or less as it should be, then the system will come up and you will be able to log in. The login screen for the CDROM will look like this:



When this screen appears, you should hear a about one second of soft music being played either through your sound card, or, if you do not have a sound card, through the speaker built into your computer. If you do not hear any music, it is not a serious problem, but it may mean that your sound card is configured differently from what Linux expects, which you may want to correct at some point. For more information on how the kernel expects your sound card to be configured, see the chapter "hardware configuration requirements."

At this point, you may want to try out the different user names that have been set up on the system. The demo account is particularly interesting, since it gives a feel for many of the capabilities of the system. However, this manual will proceed to discuss the `install` account, because that is the only account that you need to use to install LGX.

2.4 Running the installation script

One of the user names that comes preconfigured on the CDROM is `install`. When you want to install the system on your hard disk, log in with this user name. After logging in as `install`, the next screen that you see should be the following:

```
Welcome to the LGX installation script.

This script installs LGX, the Yggdrasil Linux/GNU/X Operating System,
on your hard disk.  This entails allocating a partition on your hard
disk, making a filesystem on that partition, and installing the
binaries from the CDROM onto that partition.  You will have the option
of making a swap partition and a /home partition for your personal
home directory and home directories for other users.

If you create a /home partition and put your home directory under it,
it will be easier for you to install subsequent CDROM distributions,
since you will be able to erase your old root partition without
effecting your /home partition.

When you are prompted for a response to a question, the default will
appear in square brackets.

Do you wish to continue (y/n)? [y]:
```

Hit "y", and continue to the next screen.

```
The first step of the installation is to create one or more hard disk
partitions with the 'fdisk' program.  How much space you need depends
on which configuration you choose:

        cd_dependent        The system runs from the CDROM.  Only enough
        (2 megabytes)       software to mount the CDROM plus any files that
                            you create or modify are stored on the hard disk.

        runtime             A small set of programs including a tiny
        (27 megabytes)      X window system form a minimal configuration
                            that can run without the CDROM drive.

        complete            Install everything except the non-kernel source
        (235 megabytes)     code.

        everything          Everything, including sources, is installed
        (680 megabytes)     on the hard disk.

After installation, you can use the "control-panel" command under X
windows to select software components individually.  Remember to leave
some free space for /tmp and, if you are not creating separate /home
partition, to leave space for you home directory.

[ press return to continue ]
```

2.5 Partitioning Your Hard Disk

At this point you may want to pause to consider what type of installation you want. You don't have to decide now, but deciding what kind of an installation you want to do will help you decide much space you want to allocate when you partition your hard disk.

Under the hard disk format used by Linux, DOS and all other PC operating systems that are compatible at this level, a hard disk can be partitioned into as many as four separate contiguous ranges of disk space, called *primary partitions*. If you need more partitions, there is a format that defines an *extended partition* which is primary partition which is divided into subpartitions called *logical drives*. Logical drives and extended partitions are treated as individual block devices under Linux, although it is possible to address the disk as a whole. For example, the first IDE/MFM/ESDI hard disk is `/dev/hda`, while its primary partitions are `/dev/hda1` through `/dev/hda4`. Logical drives start at `/dev/hda5`.

To install LGX on your hard disk, you need to have an unused area of your hard disk on which you can create a new partition. It is not enough simply to have space in a DOS partition which you are not using. There is an untest program on the CDROM named '`/fips.exe`' that purports to be able to shrink a DOS "FAT" file system partition non-destructively. Use this program at your own risk. You are strongly advised to back up your DOS partition before running `fips`. For more information on `fips`, look in '`/usr/src/dos/fips-0.8`' (or '`\usr\src\dos\fips-0.8`' if you're looking at the CDROM under DOS).

For some reason, hard disks under Linux are traditionally named with an alphabetic character rather than with a number. For example, the first IDE/MFM/ESDI hard disk is `/dev/hda`, the second IDE/MFM/ESDI hard disk is `/dev/hdb`. Similarly, the first SCSI hard disk is `/dev/sda`, the second SCSI hard disk is `/dev/sdb`, and so on.

For the most part, you will be considering the partitions within your disk drives rather than the entire drives themselves. The step that you are about to take is to create those partitions within your hard disk. You should create one partition which is big enough to hold the LGX configuration that you select. You may also want to create a separate partition to hold your personal files. That way, when you update your system to the next LGX release, you can quickly replace the root partition in its entirety without losing any of your personal files.

In addition, you may want to allocate a swap partition if you want to run programs that use a lot of memory on machines that do not have much RAM. If your system has 4MB of RAM or less, then **you must allocate a swap partition in order for the installation process to have enough memory to make your filesystems.**

Now hit RETURN to continue to the next screen.

```
If you want to be able to boot Linux from your hard disk, don't forget
to mark the root partition as active with the "a" command in fdisk.

You must specify the hard drive to partition.  For standard hard disk,
drive 1 is /dev/hda and drive 2 is /dev/hdb.  SCSI disk drives
follow a similar naming scheme: /dev/sda is drive 1, /dev/sdb is
drive 2, and so on.  When you are done partitioning your hard disk,
type 'done' at the prompt.  To skip the partitioning step (e.g., if
you are installing over an old Linux installation, or have already
done this step), type 'skip'.  To abort the installation now, type
'abort' at the prompt.

Again, here are the minimum partition sizes for the different types of
configurations.

cd_dependent: 2MB     runtime: 27MB     complete: 235MB     everything: 680MB

Drive to partition (/dev/hda|/dev/hdb|/dev/sda|/dev/sdb|done|skip|abort):
```

The prompt is asking you for the name of a disk drive. When you select a disk drive, you will be put into the Linux `fdisk` program for creating disk partitions within that drive.

For example, you might select drive `/dev/hda`. Then, you be put into `fdisk`, where might allocate, say 235 megabytes for primary partition 1, which you might use as your root partition for the `complete` installation configuration. After you had partitioned your hard disk, this first would be `/dev/hda1`.

Note that this is the first point in the installation script when you actually write to the hard disk. Actually, nothing is written until you exit from the fdisk program, so it is safe to go into the fdisk program just to try it out, as long as you make sure that you only look and don't change anything. You can also run the fdisk program from the regular command line outside of the installation script if you're logged in as root.

Sometimes when you run fdisk and change the disk geometry, it is necessary to reboot in order for the kernel to be able to safely adjust to the new disk partitioning. Normally when you do the installation from CDROM, it will not be necessary to reboot, but, if it is necessary to reboot, the installation script will detect this, will tell you, and will automatically do the reboot for you if you want. In any case, when select a disk to partition, you will be put into the fdisk program, which will look something like the following.

```
Drive to partition (/dev/hda|/dev/hdb|/dev/sda|/dev/sdb|done|skip|abort):
/dev/sda

Disk /dev/sda: 64 heads, 32 sectors, 1003 cylinders
Units = cylinders of 2048 * 512 bytes

   Device Boot  Begin   Start     End  Blocks   Id  System
/dev/sda1           1       1     256  262143+  83  Linux
/dev/sda2         257     257     802  559104   83  Linux
/dev/sda3         803     803    1003  205824   83  Linux

Command (m for help):
```

If you did have to reboot after running fdisk, you will have to log in as `install` again and skip through the previous steps. Eventually, you will catch up to this point, which is where you designate which partitions will be used for what. The first step is to select a swap partition if you are going to use one. You select the swap partition first so that it can be used if you need more virtual memory than your machine's physical memory can hold when you make the filesystem:

```
We now continue the installation process after having partitioned the
disk.  The next steps in installing Linux are optionally to designate
one of these partitions as being for swapping and to make filesystems
on one or more of the other partitions that you have created.

Linux knows about the following partitions:


Disk /dev/sda: 64 heads, 32 sectors, 1003 cylinders
Units = cylinders of 2048 * 512 bytes

   Device Boot  Begin   Start     End  Blocks   Id  System
/dev/sda1           1       1     256  262143+  83  Linux
/dev/sda2         257     257     802  559104   83  Linux
/dev/sda3         803     803    1003  205824   83  Linux


Choose a swap partition (optional) [none]:
```

If you designate a swap partition, that partition must be between 40 kilobytes and 128 megabytes in size.

Again, if your system has 4MB of RAM or less, then **you must allocate a swap partition in order for the installation process to have enough memory to make your filesystems.**

2.6 Creating Filesystems

The next step is to make your filesystems. In DOS parlance this is known as "formatting" the disk partition, but in Linux it is called "creating a filesystem." The installation script is set up to prompt you for a root filesystem and a /home filesystem. Later, you can add other filesystem manually once you've installed your system. Here is what you should see when you are prompted to make your filesystems:

```
The following prompt accepts four commands:

        mkfs -c /dev/hdxx       - make a filesystem on the specified
               or                 partition (by default, the filesystem
        mkfs -c /dev/sdxx         is "ext2", by the way).

        where xx identifies the drive and partition.  For example,
        "mkfs -c /dev/sda2" makes a file system on partition 2 of
        the first SCSI disk ("a").

        list                              - list the partitions again.

        done                              - done with this step

        abort                             - abort out of this script

Action (mkfs|list|done|abort):
```

On many Linux systems, `mkfs` builds the minix filesystem by default. You can create a minix filesystem or an old "extended" filesystem with the commands `mkfs -t minix` or `mkfs -t ext`; however, you would be well advised to stick with the ext2 ("extended filesystem version 2") filesystem, which is the default.

Note that the term names "extended filesystem" and "extended filesystem version 2", which are simply names of filesystem formats, have nothing to do with "extended partition," which is a DOS term for a way of breaking up one of the four primary partitions on a hard disk so that a disk can have a total of more than four partitions.

At this point, you have made your filesystems, but you haven't indicated which filesystem will be your root filesystem and which filesystem will be the /home directory for personal accounts.

```
Now tell the system which partition you want to use for the root, and
optionally, for /home.

For a reminder of the partitions available, type 'list' at any of the
prompts.  If you don't wish to specify a partition, select 'none'.


Root partition [/dev/hda1]:

/home partition [none]:
```

The next step is to select the type of installation that you want to perform. The "cd_dependent" configuration requires several minutes of use every time you reboot your computer before it becomes reasonably responsive. If you have enough disk space, you should probably at least do a "runtime" installation. After you have done the installation and rebooted, you can use the `control-panel` command under X windows to install other software components individually. On the other hand, if you want everything, then you will save yourself some hassle later by selecting `complete` or `everything` now:

```
Mounting root partition...

Now you must decide on the configuration in which the system will be
installed.  Once again, here are the choices and their disk usages:

cd_dependent: 2MB    runtime: 27MB    complete: 235MB    everything: 680MB

You can also choose 'abort' to abort the installation at this point.

Once you have selected a configuration, the installation script will
begin copying the files from the CDROM to your hard disk.  If you
choose any configuration other than 'runtime', this copying will take
some time--enough time for the screen saver to activate.  To wake up
the screen saver without sending additional characters to the
installation script, hit a key on the keyboard that does not send
characters by itself, like one of the shift keys, for example.

In the mean time, you may want to walk the dog, get a sandwich or find
some other way to pass the time while all of the files are copied from
the CDROM to your hard disk.

Installation configuration
Choices: runtime standard complete
Installation configuration [standard] -->
```

When you have selected the configuration to be installed on your hard disk, the installation of files will begin:

```
Installation configuration [standard] --> runtime

Installing files...
.Xdefaults
.bash_history
.bashrc
.calendar
.emacs
.xmfmrc
bin/
bin/adduser
bin/agetty
bin/basename
bin/bash
bin/cat
bin/chgrp
...
```

This copying process can easily take long enough for the screen blanker to take effect. As the installation script says, to wake up the screen saver, hit a key on the keyboard that does not send a character (e.g., `SHIFT` or `CTRL`). That way, you won't send characters that later parts of the installation script might misinterpret.

A double speed CDROM drive can theoretically transfer one megabyte every three seconds. A regular speed CDROM drive takes at least six seconds per megabyte. Filesytem performance will actually be substantially slower than the theoretical maximum speed of the CDROM drive. This means that for the `complete` configuration, this phase of the installation can last the better part of an hour. You may want to find something to do to pass the time, such as having lunch, or leafing through the rest of this manual. Indeed, if you know something about unix-like operating systems, there is a good chances that got to this point in the installation script without reading this manual and that you are only now reading this paragraph because you've been browsing through this manual while wondering how long this part of the installation process will take.

Fortunately, the rest of the rest of the installation process is quick. Eventually, the file copying will end and you should see something like the following

2.7 Naming Your System

```
...
var/xconfig/Xserver
var/xconfig/Xconfig.middle
var/xconfig/Xconfig
var/xconfig/Xconfig.8514
var/tmp/
vmlinux
Installation of files complete.

What would you like to name your system? [linux]:
```

If you are on the internet, you should provide your complete internet host name to this prompt (e.g., `linuxbox.Berkeley.EDU`).

2.8 Installing LILO

```
What would you like to name your system? [linux]: hal9000

Generating /etc/rc.local...

Generating /etc/fstab...
Configuring kernel...
Added linux

The kernel image lives in the file "/vmlinux" on your root partition.
If you ever change /vmlinux, you MUST RUN THE SHELL SCRIPT
/etc/lilo/install before rebooting or halting your system.  OTHERWISE,
YOUR SYSTEM MAY NOT BE ABLE TO REBOOT FROM DISK.  /etc/lilo install
simply contains the command "lilo -C /etc/lilo/config", so you can
use that command instead if you prefer.

The lilo boot loader can take over the master boot record of your
hard disk.  This means that lilo will be the first thing that comes
up when you boot your hard disk.  If you don't type anything to the
"boot: " prompt within five seconds, it will boot linux.  Otherwise, you
can type the name of any primary partition on your first four seven
SCSI disks or first four IDE disks, and lilo will boot from that
partition (e.g., you could type "hda1" to boot DOS if your primary
DOS partition is on /dev/hda1).

Should the Linux boot loader take over the master boot record of your
bootable hard disk (y/n)? [y]:
```

If you had a copy of the LGX beta release, you may recall that the default answer to this question was "n", and that the preample to this question

included a strong admonition to the user not to answer "y" unless Linux was the only operating system on the hard disk. However, for the LGX production release, you almost definitely should answer "y" to this question. The reason for this change is that now when LILO takes over your master boot record, it is configured to prompt you and allow to select another partition to boot. As a result, having lilo take over your master boot record does not lock you out of your other operating systems.

If you ever want to replace the LILO master boot record with the DOS master boot record, you can do so by issuing the undocumented `/MBR` option to the DOS `fdisk` program:

```
fdisk/mbr
```

If you answer "n" to take question about having LILO take over your master boot record and you've now changed your mind, do the following as root after you've installed your system and booted it:

1. Edit the '`/etc/lilo/config`', and change the line of the form `boot=/dev/hdb1` to `boot=/dev/hda` if you have at least one IDE, MFM or ESDI drive (in this example, '`/dev/hdb1`' is assumed to be your root partition). If all of your drives are SCSI, change the `boot=...` line to `boot=/dev/sda` instead of `boot=/dev/hda`. You are telling LILO to write to the master boot record of your first hard disk, not necessarily the disk on which you've installed LGX.
2. Run the '`/etc/lilo/install`' script.

2.9 Making A Boot Diskette

An alternative to booting from the hard disk is to create a boot floppy that will boot your system. You should probably make such a floppy in any case, just to be safe. You can make such a boot floppy simply by copying the kernel ('`/vmlinux`') directly onto a blank floppy diskette (e.g., `dd if=/vmlinux of=/dev/fd0` or `cp /vmlinux /dev/fd0`). The kernel format is designed so that it also happens to be the image of a bootable floppy. Note that the kernel that is installed on your hard disk has a few bytes that changed from the kernel on the CDROM. These bytes which tell the kernel where the root partition is. If you want to create a boot floppy from the kernel on your hard disk and you can only boot from the CDROM for some reason, here is how to do it (*root* is your root partition on the hard disk, e.g., `/dev/hdb2`):

```
mount root /mnt
dd if=/mnt/vmlinux of=/dev/fd0
sync
umount /mnt
```

For you convenience, the installation script prompts you at this point to create a boot floppy in this manner, since you probably want to have keep such a floppy around in any case.

```
You should now have a useable filesystem on your disk.  In case
you ever run into problems booting from your hard disk, now would
be a good time to make a boot floppy that mounts your hard disk.
The installation script can make a boot floppy for you now if you
have a blank diskette handy.

Make boot diskette now? y
669+1 records in
669+1 records out
Done.

To make a hard disk in the future (after you have booted from the CDROM
drive) type "dd if=/vmlinux of=/dev/fd0" to the root shell.


[ press return to continue ]
```

2.10 Booting Your New System

That about wraps it up. Now all you have to do is boot your new system. Since you probably want to reboot immediately, the installation script prompts you for this too. If you have not done so already, be sure to remove the LGX boot floppy from your drive before you reboot.

```
That completes the installation.  Now would be a good time to
try booting your newly installed system.  If you reboot now,

If you want to try booting your system from the hard disk, shut down
the system (log in as root, issue the "halt" command, and wait for the
message that it is okay to turn the power off), remove the floppy disk
if there is one in the drive and reset the computer.

When you start X windows with the "xinit" command for the first time,
you will automatically be prompted for X configuration information.
Once you have started X windows, you can make some other system
configuration changes by running the "control-panel" program as
root.  (Do a "control-panel &" from a root shell in an xterm window.)

Reboot the system now (y/n)? [n]:
```

2.11 Creating an account for yourself

Once you have installed the system, you will probably want to create an account for yourself.

First, log in as root and add a line for your login name in /etc/passwd. An /etc/passwd line consists of six colon-separated fields. The first field is the login name. The second field is the encrypted password. An empty encrypted password field means that a password is not needed in order to log into the account. When you create an account, you normally create it without a password and then add a password by logging into the account and using the "passwd" command. An asterisk ("*") means that no password is valid. The third field is the numeric user ID for the account, which should normally be a number unique to the account. User ID 0 is the superuser. The fourth field is the file group ID for your account. You can add more groups to the account by listing the account in the last field of the appropriate line in /etc/group. People who are authorized to do system administration are supposed to belong to group 0, so group 0 is a logical choice for your account's primary group. The fifth field is the personal name information associated with the account. The sixth field is your account's home directory. It is common to put one's home directory under /home. The seventh field is your shell.

Your /etc/passwd line should look something like this:

```
smith::600:0:John Smith:/home/john:/bin/bash
```

After you have created your username by editting /etc/passwd, create your home directory, copying the guest account's configuration files, and making yourself the owner of it:

```
cp -r ~guest ~fred
chown fred ~fred
```

2.12 The X Window System

2.12.1 The X Configuration Script

When you run `xinit` for the first time, you will be prompted for X configuration information. The information that you provide will normally be enough to enable the X server to start automatically.

Here is what you should see the first time you run `xinit`, or if you run `xinit` after having deleted the files in /var/xconfig.

```
It appears that you have not yet configured X windows. This script
will configure X windows for the system. You can safely abort this
script at any time by hitting CONTROL-C.

        If you are using a Microsoft bus mouse, a Logitech bus mouse, an
ATI bus mouse or any other type of bus mouse, enter "busmouse" to the
following questions.  The keywords "logitech" "microsoft", "mmseries",
etc.  Refer to different types of SERIAL MICE.  If you answer
"busmouse", the question following this one will ask you which type of
bus mouse you have.

Mouse type
Choices: busmouse logitech microsoft mmseries mouseman mousesystems xqueue
Mouse type [microsoft] -->
```

Here is a more detailed description of what these keywords mean:

`busmouse` Any bus mouse. Specify this keyword even if your bus mouse is made by Logitech or Microsoft.

`logitech` Logitech *serial* mouse only. Do not use the keyword to refer to the Logitech "MouseMan" series of serial mouse. Instead specify `mouseman`.

`microsoft`
Microsoft *serial* mouse.

`mmseries` Perhaps this keyword is synonymous with `mouseman`?

`mouseman` Logitech "MouseMan" serial mice.

`mousesystems`
A serial mouse from MouseSystems.

`xqueue` Serial mice from some company named "XQueue?"

The next step after selecting your mouse is to select the device through which it is connected. If you specified a serial mouse, you will be prompted for a serial mouse. If you specified a `busmouse` as your mouse type, you will now be prompted the various bus mouse devices. It is through these device interfaces that the system differentiates between the different types of mice.

```
Serial port for mouse
Choices: ttyS0 ttyS1 ttyS2 ttyS3 ttyS4
Serial port for mouse [ttyS0] -->
```

If you specified a serial mouse, you will also be prompted for the baud rate of you mouse. Almost all serial mice run at 1200 baud.

```
Mouse baud rate
Choices: 1200 9600
Mouse baud rate  [1200] -->
```

Having taken care of the input side of the X server, the configuration script moves on to ask you about your display. If you have a VGA card and you think that you are using one of the X server's supported chipsets, then you might as well select AUTODETECT and see if the server can correctly infer your video chipset. That way, you might not have to reconfigure X if you change video cards in the future.

```
Type of video card
Choices: AUTODETECT hercules monochrome-vga s3 et4000 et3000 pvga1
wd90c00 wd90c10 wd90c30 gvga ati tvga8900b tvga8900c tvga8900cl
tvga8900cs clgd5420 clgd5422 clgd5426 ncr77c22 ncr77c22e cpq_avga 8514
Type of video card [AUTODETECT] -->
```

Here is what the different keyword mean:

AUTODETECT
: You have one of the supported VGA chipsets, but you'll let the server attempt to sense which one. If your video chipset is not supported, then specifying AUTODETECT won't help you. Instead, you'll have to use monochrome-vga, which theoretically supports all VGA cards at 640x480 monochrome. Also note that you cannot specify AUTODETECT in place of hercules, S3, monochrome-vga, or 8514 , because these selections use different X servers.

monochrome-vga
: Theoretically, this server works with any VGA display, at least at 640x480. However, it is only monochrome.

s3
: S3 Corporation (formerly Silicon Subsystems) graphics accellerators. You may have to uncompress some the fonts that you want to use in order to use this server. (See the "Errata" section of the "Trouble Shooting" chapter.)

et3000
et4000
: Tseng Labs ET3000, ET4000 and ET4000/W32 chips.

pvga1
: Western Digital "Paradise" VGA card.

wd90c00
wd90c10
wd90c30
: Western Digital's 90c00, 90c10, and 90c30 graphics accelearators.

gvga
: Genoa VGA

`ati` ATI VGA Wonder XL, ATI Ultra Pro, and possibly other ATI

`tvga8900b`
`tvga8900c`
`tvga8900cl`
`tvga8900cs`
`tvga9000` Trident VGA chips.

`clgd5420`
`clgd5422`
`clgd5426` Cirrus Logic VGA chips and graphics accelerators.

`ncr77c22e`
`ncr77c22` NCR VGA chips

`cpq_avga` Compaq AVGA

`8514` 8514-compatible graphics accelerators. The X server does not currently take advantage of the graphics acceleration. If you have an ATI Mach-series card, try specifying AUTODETECT to "ati" rather than 8514. The 8514 server only supports resolutions up to 1024x768, while you can go up to 1152x900 with the regular VGA server. Also, the 8514 server does not appear to be any faster than the regular VGA server.

`hercules` 720x350 monochrome Hercules card. We were unable to get a monochrome monitor for testing before this manual went to print. So, whether or not this driver actually works is an open question.

WARNING: All cards made by Diamond use a nonstandard mechanism for selecting the video clock, which Diamond refuses to disclose without a signed nondiscloure agreement. Consequently, if you have a Diamond card, you may not be able to use it, even if it uses one of the supported chipsets. '`/usr/bin/freq`' is a program that allegedly allows one to set the clocks on a Diamond card. Look in '`/usr/src/usr.bin/diamond`' for more information on trying to make Diamond cards work with the X server.

The next question is intended for unusual cases where the X server incorrectly to guesses speeds of your VGA card's video clocks.

```
        The X server can usually guess the oscillator speeds of your
VGA card.  However, if the X server makes a mistake, you can force
the server to see a specific set of video clocks by entering the clocks
here.  Order is significant.  Use "0" for any oscillators that the X
server should not use.  If you don't know of problems with your X server
determining your video card's clock speeds, then just hit the RETURN
key here.

VGA clocks []:
```

Unless you know that the X server does not work without the VGA clocks being specified, hit RETURN here.

```
                                WARNING

Because the color X server uses 8 bit pixels, you must have 2
megabytes of video memory on your video card if you select a maximum
resolution of 1280x1024i or 1280x1024.  Even then, the X server does
not work right for resolutions of 1280x1024 and 1280x1024i with many
video cards.  If your monitor and video card can do 1280x1024 or
1280x1024i, you may have to settle for 1152x900 for now, which, by
the way, also works with 1 megabyte video cards.



What is the maximum resolution that you want to use for your video
card and monitor?  (The "i" suffix means "interlaced only.")

Maximum resolution
Choices: 640x480 800x600 1024x768i 1024x768 1152x900 1280x1024i 1280x1024
Maximum resolution [1024x768] -->
```

Currently, the X servers do not seem to support more than a megabyte of RAM, although the VGA X server has options for it which apparently do not work. For this reason, the X configuration script provides an 1152x900 resolution so that you take some advantage of video cards that go fast enough to do 1280x1024 non-interlaced, such as the ATI Ultra Pro.

```
microsoft "/dev/ttyS0"
BaudRate 1200
vga256
Modes "1024x768" "1024x768i" "800x600" "640x480"

NOTE TO CDROM USERS:
        If you are running X from an especially slow CDROM drive, the
X server may time out the first time that you run it.  If the X server
times out, try running it again, because, this time, most of the
blocks that need to be read from the CDROM will already be in RAM.
In any case, running X from the CDROM will be extremely slow initially,
but will speed up over the course of a few minutes as the code that
you are using migrates from the CDROM to RAM.


Hit RETURN to continue.
```

As it says, hit RETURN.

```
*************************************************************
  NOTE: To unconfigure X, delete the files in /var/xconfig.
*************************************************************


  To switch between video modes use <Ctrl>-<Alt>-<Numeric +>
  To switch in the other direction use <Ctrl>-<Alt>-<Numeric ->
  To kill the server in use <Ctrl>-<Alt>-<Backspace>

Hit RETURN to start X server or CONTROL-C to abort -->
```

The information provided in the above screen is quite useful. You may need to cycle through video resolutions if your monitor has trouble with your maximum resolution. Also, CTRL ALT BACKSPACE is an extremely useful feature of the X server.

2.12.2 Unconfiguring X

At some point, you may want to make the X configuration script run again (e.g., you have switched video cards or there is something that you would like to configure differently). You can make the X configuration script run the next time you run `xinit` by deleting the files that configuration files that the configuration script creates in /var/xconfig:

```
rm -f /var/xconfig/*
```

You have to be root for this command to work.

2.12.3 Advanced Installation Options: The Xconfig File

Skip this section if you are not a VGA wizard.

Although the basic X installation script should be sufficient to start the X server, you may want to understand format of the file /var/xconfig/Xconfig in order to use use some of the more advanced features of the X server, such as having a large virtual screen, or being able to tell the X server the speed of your video card's oscillators, instead of having the X server attempt to measure them (since the X server is sometimes gets them wrong).

When the X server comes up, it will attempt to measure the speed of the different oscillators on your VGA card. These measurements are fairly inaccurate and vary each time you run the X server. If you know the speeds of the different oscillator clocks on your VGA card, you can list them by adding a "Clocks" line to the file /var/xconfig/Xconfig. Bear in mind that order is significant and you should include a zero for any oscillator that you don't want the X server to use. If you do decide to add a "clocks" line to your Xconfig file, chances are that you will make a mistake at some point

and end up in a situation where the X server is running but you cannot see the display. If you ever find yourself stuck in the X server, typing `Ctrl-Alt-Backspace` will cause the server to exit gracefully.

The configuration of the X server is controlled by the file /usr/lib/X11/Xconfig, which is a symbolic link to /var/xconfig/Xconfig. By editting /var/xconfig/Xconfig, you can configure the server to use your mouse and, generally, to drive your VGA card at whatever resolution and speed you want.

The Xconfig file follows the standard unix convention that a pound sign indicates that the rest of the line is a comment. With that understanding, it should become clear by inspection how to change options like the mouse configuration or the font path.

Configuring the video is a more arcane. You'll need to consult your video card manual and possibly your monitor manual. (Yes, the video configuration scheme ought to be changed.)

Start by uncommenting the right "Chipset" line in your Xconfig file, depending on what chipset your VGA card uses.

The "Modes" line in the Xconfig file controls which resolutions the X server will try to support. When the X server is running, you can cycle forward through the different modes with `Ctrl-Alt-Numeric +` or backwards with `Ctrl-Alt-Numeric −`.

This is where you have to consult your video card manual. In order to support a particular resolution, the X server will look for video timing information corresponding to a particular resolution and a particular video oscillator frequency. The "Clocks" line in the Xconfig file lists, in order, the speeds of each oscillator on the VGA card. Use a 0 for any oscillator that you don't want the X server to use. If there is not "Clocks" line in the Xconfig file, then the X server will attempt to figure out the speeds of each oscillator. Unfortunately, the X server usually gets this wrong, especially at oscillator high speeds. Nevertheless, the X server often comes close and the X server prints the clock speeds when it initializes, so its worth running the X server like this and immediately exitting with `Ctrl-Alt-Backspace` to see what the server thought the oscillator speeds were.

If there is already a listed combination oscillator speeds and video timing for the particular resolutions that you want to run, then you're done.

Otherwise, you'll have to create your own line of video timing information. After each resolution is a list video timing values. Then there are four increasing numbers that control the horizontal timing information, each of which must be a multiple of eight. The first number is the horizontal resolution. It represents the count of oscillator cycles from the beginning of the time the beam activates to the time the beam goes off.

The second number is the number of cycles from the time the beam activates to the beginning of the horizontal sync pulse. The third number

is the number of cycles from the time the beam activates to the end of the horizontal sync pulse. The fourth number is number of cycles from the time the beam activates to the time the beam activates for the next line.

The next four numbers are the vertical timing information. Instead of being measured in vertical oscillator periods, they are measured in units of the amount of time that it takes to display one horizontal line of video (beam active to beam active). The first number is equal to the vertical resolution; the second number indicates when to turn the vertical sync pulse on; the third number indicates when to turn it off; and the fourth number indicates when to start displaying the next frame.

Armed with this information and your monitor manual, you should be able to not only get the X server working at a standard resolution, but you should be able to adjust the timing information to get a faster refresh rate or to create a custom video resolution.

2.13 The Control Panel

To complete your system installation, you want to configure other aspects of your system, such as your printer and your ethernet. With other systems, this process would entail editting a number of configuration files and learning about a number of networking configuration commands. With LGX, this process has been ameliorated somewhat by the `control-panel` command.

You must be logged in as root and running X windows in order to use the control panel. The control panel allows you do a number of system administration tasks. In the Fall 1993 LGX release, the control panel has six buttons which invoke subpanels and a few other buttons that do other useful chores. Future releases will include more panels to automate other system administration tasks. It is particularly useful to use the control panel to configure printer, because, if you have a non-postscript printer that the GhostScript postscript emulator supports, the printer control panel will automatically arrange to pipe any postscript files that you print with the `lpr` command through GhostScript, so that it will appear that you have a postscript printer.

2.14 Remounting the CDROM

At some point in the future, you may want to remount the CDROM in order to install additional software packages, to browse other files that you do not want to keep on your hard disk, or to recover from some an accident with `rm`. The `mount` command can be used to mount the CDROM and the `umount` command can be used to unmount the CDROM when you are done. You must be the superuser (for example, logged in as root) to use these commands. You can learn how to use `mount` and `umount` with the `man`

`mount` and `man umount` commands, but the syntax for `mount` and `umount` is fairly simple:

`mount` *device mount-point*
...
`umount` *device*

The *mount point* is a directory that you specify where the CDROM will appear when in it is mounted. The mount point must exist before you use the `mount` command. The *device* is the device that you are mounting. Here are the possible choices for CDROM's:

'`/dev/cdrom`'
'`/dev/cdrom1`'
'`/dev/cdrom2`'
'`/dev/cdrom3`'
'`/dev/cdrom4`'
'`/dev/cdrom5`'
'`/dev/cdrom6`'
'`/dev/cdrom7`'

SCSI CDROM drives. '`/dev/cdrom`' is the first SCSI CDROM drive. '`/dev/cdrom1`' through '`/dev/cdrom7`' refer to subsequent CDROM drives or subsequent CDROM platters on a multi-platter CDROM drive.

'`/dev/mitsumi_cd`'

A Mitsumi CDROM drive. Your Mitsumi CDROM drive should be located at port 0x300 and should use IRQ 11, although the driver seems to work even if the IRQ doesn't match.

'`/dev/sbpro_cd`'

A CDROM drive that has the type of interface used by the SoundBaster Pro and SoundBlaster 16 ASP sound cards, although this device also supports drives attached through the standard controller card that you often get when you buy these drives separately, such as the Toptek "universal CDROM controller." Drives with this interface are sold under at least the Kotobuki, LaserMate, Matsushita, and Panasonics labels. The new double speed Panasonic CR-562 is also supported by this driver.

'`/dev/sonycd_31a`'

The Sony CDU-31A CDROM drive, used either with its standard controller or with the sound card in the MediaVision Fusion-16 kit.

'`/dev/sonycd_535`'

The Philips/LMSI CM-205 CDROM drive and the Sony 531 and 535 CDROM drives.

3 Online Documentation

Your principal source for information on the thousand-plus programs that comprise LGX is the online documentation. The online documentation can be divided into three categories:

1. "manual pages" provided with each program, which are accessible through the `man` command.
2. manuals and other large documents in '`/usr/doc`' and '`/usr/info`', which can be printed with `lpr` or searched with `grep`.
3. documentation built into programs

3.1 Manual Pages

Many programs in LGX include a page or two of online documentation which is accessible by the `man` command. Type `man` followed by the name of the system facility that you are interested in to learn about that facility. For example, type `man man` to learn about the `man` command. If you `man` does not have anything under the keyword that you give it, use the `apropos` command to see if the keyword appears in the synopses that describe other commands.

3.2 Larger Online Documentation

The directories '`/usr/info`' and '`/usr/doc`' contain more substantial documentation. In addition, the source tree for some programs also come have supplemental documentation and '`README`' files.

Of particular interest, '`/usr/doc/FAQs`' contains files with answers to lists of *Frequently Asked Questions*. The files contain the collective wisdom of many Linux users who have probably asked the very questions that you may be asking yourself about any particular system facility. These files deal not only with questions related to common problems, but also often explain more general issues about why certain facilities are set up the way they are or what the current state of the art is for certain Linux facilities. If you have a question about a system facilities, a way to start investigating it is to '`cd`' into '`/usr/doc/FAQs`' and use `grep` to search these files for keywords that might be relevant to your questions. (Do a `man grep` to learn more about grep.)

If you want a more structured introduction to the various system facilities, you may want to look at the "guide" subdirectories of '`/usr/doc`'. These subdirectories contain guides that are designed to provide an step-by-step introduction to a different aspects of using the system. You may notice that these subdirectories have files that have copies of the guides in a number

of different formats. You can figure out what format these files are in from each file's extensions:

'.dvi' You can view the file under X with `xdvi` or convert it to PostScript for printing with `dvips`.

'.gz'

'.z'

'.Z' Compressed. Use `zcat` to type the uncompressed file, or use `uncompress` to uncompress the file on disk (this will not work if the directory that you are in is on the CDROM). The '.Z' extension is an older compression format, but these programs understand both formats. The standard extension name for the new format was recently changed from '.z' to '.gz', which is why you will see both extensions used.

'.ps' Postscript. You can view this file under X windows with `ghostsview`, or print it if you have configured your printer, and your printer either has PostScript built in or is one that GhostScript knows how to drive.

'.tar' a `tar` archive which may contain several files. Only the source directories used to make the documentation are stored as tar files, so if you're doing something that requires you to look at these files, you should already know all about the `tar` command. However, the `tar` command is quite useful, since almost all software distributed on the net is distributed in tar archives. Do a `man tar` to learn more about tar.

'.tgz' This is short for .tar.gz. It indicates a tar archive that has also been compressed.

'.txt' Text.

One last item of note in '`/usr/doc`' is the BBS list. You may want to look through the BBS list to fine computer bulletin boards where you can communicate with other Linux users.

3.3 Documentation Built Into Programs

Many of the programs in LGX have a some documentation built into them. For example, `bash`, the default shell, has a `help` command. For interactive programs, try commands like '`?`', '`h`', '`help`', '`doc`'. In emacs, you can get help with the `CTRL H` key, although this will probably be rebound to `META H` in the next release of LGX so that `BACKSPACE` will work properly across serial connections. In unix-like operating systems, there is a convention that when programs are invoked with arguments that they do not understand, they print a "usage:" line before exiting, which gives a synopsis of how to use the program. Some programs also recognize a "-help" or "–help" argument

as a standard way of evoking this response. Here is an example of invoking help.

```
linux# cp -junk
cp: illegal option -- j
Usage: cp [options] source dest
       cp [options] source... directory
Options:
     [-abdfilprsuvxPR] [-S backup-suffix] [-V numbered,existing,simple]
     [--backup] [--no-dereference] [--force] [--interactive]
     [--one-file-system] [--preserve] [--recursive] [--update] [--verbose]
     [--suffix=backup-suffix] [--version-control=numbered,existing,simple]
     [--archive] [--path] [--link] [--symbolic-link] [--help] [--version]
linux#
```

With these techniques for accessing online documentation, you should be able to navigate the plethora of programs which are LGX. With over a thousand programs on the CDROM, there is a lot to explore. You might want to do an `ls` on '`bin`', '`/usr/bin`' and other directories in your PATH (viewable with the `echo $PATH` command), to get an idea of what is out there. The following chapter will give suggest a few features that you won't want to miss.

4 Some Interesting LGX Features

This chapter exists to point out a few of the more interesting features of LGX. This chapter is not essential reading. You can read this chapter at your leisure.

4.1 Sound

By default, the kernel is configured to look for a Soundblaster-compatible sound card on IRQ 7, and a Media Vision Pro Audio Spectrum 16 card on IRQ 10. As always, you have a choice between configuring your cards to match the expectations of the kernel and rebuilding the kernel to match your cards. If you want to rebuild the kernel, note that the IRQ numbers for the sound cards are controlled by the top level Makefile (look for the string "SBC_IRQ").

You may also want to rebuild the kernel if you have a Gravis Ultrasound card or an MPU-401. The kernel source has drivers for these sound cards, but they are not configured into the standard kernel that is shipped with the LGX production release because they cause systems with certain hardware configurations to hang during the boot process. See the section "Rebuilding the Kernel" for more information on how to reconfigure and rebuild your kernel.

You can use the `splay` program to play ".snd" sound files. By default, splay plays 8-bit monophonic sound, but it has options to play stereo ("-S") and to play other 12-bit or 16-bit sound samples ("-b"). Type `splay -help` for a synopsis.

You can also synthesize instrumental music with `fmplay`. Before using `fmplay`, you must load instruments onto your sound board with the `sbiset` command. The file /usr/sound/fm/setall will install 128 instruments on your sound board. You may want to run /usr/sound/fm/setall and then use fmplay on the sample MIDI files in the /usr/sound/fm/midifile directory.

There is also a `midplay` program is like `fmplay`, except that except that it plays MIDI files directly over the MIDI interface on your sound card.

4.2 The MPEG video player

The MPEG video player is /usr/bin/X11/mpeg_play. Type `mpeg_play -help` for more information on mpeg_play and look in ~demo/ for two sample MPEG files, birdisba.mpg and hulahoop.mpg.

4.3 Ghostscript: the GNU postscript emulator

Ghostscript is a postscript emulator that can draw to an X window, a number of printers, or to data files in a number of formats, including fax file formats. You can get a brief synopsis of how to use ghostscript and what devices are supported with the command `gs -help`. There is documentation on ghostscript in /usr/lib/ghostscript/doc.

If you want to look at postscript in an X window, check out `ghostview`, which is a program that uses ghostscript to allow you to browse a postscript file in an X window.

4.4 Tcl, Tk, Wish, and Expect

Tcl is a scripting language ("tool command language") written by Professor John Ousterhout at UC Berkeley. Tcl is accessible as a library /usr/lib/libtcl.a, which other programs can use. The Tcl README file suggests some sources of information on Tcl:

> For an introduction to the facilities provided by Tcl, your best bet is to retrieve the partial draft of the Tcl/Tk book, which is available for FTP from the standard Tcl/Tk release directories. Another possibility is to see the paper "Tcl: An Embeddable Command Language", in the Proceedings of the 1990 Winter USENIX Conference. A copy of that paper is also available in Postscript form in the distribution directory. However, the paper corresponds to a much earlier version of Tcl (approximately version 3.0), so some details of the paper may not be correct anymore and there are many new features not described in the paper.

Tk is a toolkit that allows one to quickly write X-windows programs in Tcl. Wish is an interpretter for Tk. Using wish seems to be the typical way that people learn to use Tk and Tcl. You can invoke `wish` as a command and play with it.

You can read about Tk and wish in Professor John Ousterhout's paper, "An X11 Toolkit Based on the Tcl Language" in the Winter 1991 USENIX conference proceedings. The source code for the hypertext, barchart and graph extensions to Tk is in /usr/src/usr.bin/graph-1.0.

Getting away from X, expect is a system written in Tcl Don Libes that "performs programmed dialogue with other interactive programs." Expect scripts in /usr/bin include archie, weather, rftp, and kibitz. The expect README file suggests some sources of information on expect:

> The implementation, philosophy, and design of expect are discussed in "expect: Curing Those Uncontrollable Fits of Interaction", Proceedings of the Summer 1990 USENIX Conference, Anaheim, CA,

June 11-15, 1990. Examples and discussion, specifically aimed at system administrators, are in "Using expect to Automate System Administration Tasks", Proceedings of the 1990 USENIX Large Systems Administration Conference (LISA) IV, Colorado Springs, CO, October 17-19, 1990. A comprehensive paper of example scripts is "expect: Scripts for Controlling Interactive Programs", Computing Systems, Vol. 4, No. 2, University of California Press Journals, 1991. Regression and conformance testing is discussed in "Regression Testing and Conformance Testing Interactive Programs", Proceedings of the Summer 1992 USENIX Conference, San Antonio, TX, June 8-12, 1992. An explanation of some of the more interesting source code to Expect itself is in Chapter 36 ("Expect") of "Obfuscated C and Other Mysteries", John Wiley & Sons, 1993. A paper on connecting multiple interactive programs together using Expect is "Kibitz - Connecting Multiple Interactive Programs Together", Software - Practice & Experience, to appear.

4.5 The Andrew System

The Andrew System is a multimedia system, consisting of applications and a toolkit. The most useful application is `ez`. `ez` is an editor for easy creation and reading of documents with imbedded images, equations, spreadsheets, hypertext links, and many other media types. When you're running X windows, `ez /usr/andrew/doc/AtkTour/Media` will invoke the `ez` editor a file that shows most of the builtin Andrew media types. This file is part of a tour of the Andrew system, which you can access with the command `ez /usr/andrew/doc/AtkTour/Tour`. You can get topic-specific help on andrew with the `ez /usr/andrew/bin/help` comand. Note that you have to type in the full path name, because the command '`help`' by itself will invoke the help function that is built into the Bourne Again Shell.

If you are running either the `fvwm` or `twm` window managers in the default configuration, then you can also invoke these commands from the menus that are invoked when you click on the root window (the root window is background area of the screen, i.e., the area that is not covered by any other window).

4.6 X Windows Games: Asteroids, Battlezone, Chess, Connect Four, Lunar Lander, Mille Bornes, Othello, Pool, Shogi, Solitaire, Xtank.

The easiest way to invoke invoke one of the X windows games is to use the built in root menus mentioned in the last paragraph of the section "The

Andrew System." If you want to know exactly what the file names of these programs are, do a `ls /usr/games/bin`.

4.7 TCP/IP, NFS, and your ethernet adapter

You can configure TCP/IP networking, with the `control-panel` command when you're logged in as root under X windows. To unconfigure TCP/IP, delete the file /etc/rc.net and reboot. If you are on a network running, TCP/IP, you should be able to mount and unmount NFS filesystems in the same way that you would on any other workstation:

```
mount -t nfs hostname:/remotefilesystem /local_mountpoint

umount /local_mountpoint
```

4.8 Other useful programs

There are many other useful programs that you might want to try. For example, the TEX typesetting system (the command name is `tex`) complete with xdvi for viewing the DVI format output in an X window and dvips for converting the DVI format output to PostScript.

For telecommunications, there is kermit and, for uploading, z-modem. The zmodem commands are `rz` and `sz`). If you want to use upload with zmodem, you can do so by starting the sz command on the remote machine, suspending kermit (with Ctrl-\ Ctrl-Z) and then running rz with its standard input and output redirected to the modem, for example:

```
rz < /dev/ttyS1 > /dev/ttyS1
```

5 Other Interesting CDROM's

If you bought a CDROM drive for the purpose of running LGX, you may now be looking for other interesting CDROM titles to run with your CDROM drive. Here are a couple of companies that make other interesting freeware CDROM's that you may be interested in.

InfoMagic, Inc.
Post Office Box 338
Pennington NJ 08534
(609) 683-5501
fax (609) 683-1342

Prime Time Freeware
370 Altair Way, Suite 150
Sunnyvale, CA 94086
(408) 433-9662, fax: (408) 433-0727

Walnut Creek CDROM
1547 Palos Verdes Mall #260
Walnut Creek, CA 94596
(510) 674-0783
fax (510) 674-0821

6 Last Minute Additions

It is possible that there may be last minute additions made to your release of LGX after the manual went to print. These last minute changes might include, for example, a new version of the kernel with patches to the source tree. If there are any such changes, they will be documented on the floppy disk in the file '`README`'. To access this file, insert the LGX boot floppy in your first floppy drive and type:

```
mount /dev/fd0 /mnt
more /mnt/README
umount /dev/fd0
```

If there is no README file, then there were no last minute additions.

7 LGX Hardware Requirements

System RAM: 4MB (8MB without swap partition), CPU: 386 or above, Bus: ISA, EISA, or localbus.

Hard Disk IDE, RLL, MFM, ESDI, SCSI **with supported SCSI controller.** LGX can be installed to use from 2 to 680 megabytes of disk space. Configurations that run without the CDROM and do not include the non-kernel source tree range from 27 to 235 megabytes. LGX can share a hard disk with DOS or other operating systems on separate partitions, although you do not need any additional software to run LGX.

Tape SCSI tape **with supported SCSI controller**. Experimental floppy tape and QIC-02 drivers are also included, but you're on your own as far as making them work. The QIC-02 driver is not configured into the standard kernel because it can make the kernel hang if you do not actually have a QIC-02 tape drive connected to your system. To build the QIC-02 driver, cd to '`/usr/src/linux`' and type `make config`. Answer "y" to the question about QIC-02 support. Build a new kernel by typing `make`, then copy the kernel onto a floppy (e.g., `dd if=zImage of=/dev/fd0`) and reboot from the floppy. The floppy tape driver is an installable user-level device driver. Look in '`/usr/src/usr.bin/ftape-0.9.5`' for instructions on installing and using the floppy tape driver.

CDROM Drives

- Any SCSI CDROM drive **with supported SCSI controller**
- Sony 531 or 535,
- Sony CDU-31A, alone or with MediaVision Fusion 16 kit,
- Kotobuki, LaserMate, Matsushita, and Panasonic CR-5xx, including the new double speed Panasonic drive. These are drives that can be connected to a SoundBlaster sound card.
- Mitsumi/Genstar, alone or through ATI Stereo FX.

SCSI controllers

Adaptec 1540B, 1542B, 1540C, 1542C, and 1740 in enhanced mode; Always IN-2000, Future Domain 16xx series, Future Domain 8xx series, Seagate ST-01, ST-02, and other controllers based on the TMC-950 chip, Ultrastor 14F, 24F and 34F, Western Digital 7000fasst. Experimental drivers for the Adaptec 1520/1522 and Trantor T-128/128F/228 controllers are also included, but **both of these drivers are known not to work with many hardware configurations.** For this reason, these controllers are not listed on the hardware compatibility list on the back of

the manual. On the other hand, some people are using these drivers successfully. Since these driver do not do anything unless you have the appropriate card in your system, they have been included and configured into the kernel.

Video cards (for X windows)

Any VGA card will work at up to 800x600 monochrome. 256 colors and resolutions up to 1024x768 or 1152x900 supported with cards using the following chipsets: S3, 8514, Tseng Labs ET4000 or ET3000, Paradise, Western Digital 90c00, 90c10 or 90c30, Genoa, ATI VGA Wonder, ATI Mach (e.g., the ATI Ultra Pro), Trident 8900b, 8900c, 8900cl, 8900cs, Cirrus Logic 5420, 5422 or 5426, NCR 77c22 or 77c22e, or Compaq AVGA. There is also code that is supposed to support Hercules Monochrome cards. However, we were unable to get a monochrome monitor for testing before this manual went to print.

Sound Cards

Adlib, SoundBlaster (regular, Pro and 16 ASP), MediaVision (Fusion and ProAudioSpectrum 16), and ATI Stereo FX. Installable Gravis Ultrasound and MPU-401 drivers are also included. If you do not have a sound card, LGX can play sounds through your PC's speaker.

Ethernet 3Com 3503 and 3c503/16, Artisoft LANtastic AE-2, ATI 1500, Alta Combo, Cabletron, D-Link DE600 pocket adaptor and ethernet II, Hewlett-Packard 27245, 27247, 27250 and PCLAN, Novell NE-1000, NE-2000, and NE-2100, Western Digital 8003 and 8013, other 8390-based ethernet cards.

8 Trouble Shooting

8.1 Isolating Hardware Problems

By far the most common types of problems that users report are hardware misconfiguration or hardware incompatability. If you experience a problem that may be hardware dependent, please try to reproduce it after you have removed every piece of nonessential hardware from your system. If the problem does not recur with a minimal hardware configuration, try adding the other components until you have determined the minimal hardware configuration that cause the problem to occur. Once you have determined this minimal hardware configuration, record the make and model of each card in your computer and its hardware configurations (IRQ, IO address, memory address, and DMA channel). If you do this before you call Yggdrasil to report the problem, there is a better chance that we will be able to fix it in the next release of LGX. Nevertheless, we still want to report any bugs that you find, even if you are unable to provide us with this information which can make the bug fixing process more efficient.

8.2 Address Conflicts: Interrupts, DMA Channels, IO ports,

If you are experiencing a problem with a device freezing after a few seconds of use, or a device not being recognized, you might have two devices using the same interrupt ("IRQ") line. Other spaces where collisions are possible are DMA channels, IO ports and the memory addresses, which are usually used only to hold the BIOS ROM information. You may want to make a chart of your PC's hardware configuration to make sure that you do not have any other these conflicts. Here is a chart of possible configurations for common PC hardware devices. Parenthesized numbers indicate default values. Bracketed numbers indicate values that are not supported under the current Linux kernel.

	IO ports	IRQ	DMA	BIOS
ttyS0 (COM1:)	3f8	4	--	--
ttyS1 (COM2:)	2f8	3	--	--
ttyS2 (COM3:)	3e8	4	--	--
ttyS3 (COM4:)	2e8	3	--	--
lp0 (LPT1:)	378-37f	7		
lp1 (LPT2:)	278-27f	5		
Floppy disks:				
fd0, fd1	3f0-3f7	6	2	
fd2, fd3	370-377	10	3	

IDE, MFM or ESDI hard disks:

SCSI controllers:

Adaptec 1542B	334,(330),234 230,134,130	9,10,(11) 12,14,15	7,6 (5),0	(dc000),cc000 d8000,c8000
Adaptec 1740B	(Given by EISA)	9,10,11, 0,14,15		
Seagate STxx*/ Future Domain 8xx/ TMC-950		[*],[3] 5,[7]		(ca000),c8000, ce000,de00
Ultrastor 14F/24F/34F	(330),340, [310],230,240, 210,130,140	15,14, 11,10	5,6,7,0	none],c4000, c8000,cc000, d0000,d4000, dc000,d8000
Western Digital 7000FASST	350	15	6	any
Always IN-2000	220,200,110,100	any	unused	

Proprietary CDROM interfaces:

Mitsumi -	300	11	unused	---
Soundblaster Pro	(220),240	unused	unused	
Panasonic/Lasermaster	300,310	unused	unused	
Sony cdu31a	(340),360 320,330	unused	unused	
Sony cdu31a + Fusion16	1f88	unused	unused	
Sony 535 or Sony 531	340	unused	unused	

Sound cards:

Adlib/Soundblaster	220	7	1
ProAudioSpectrum-16	388	5	3
MPU	330	6	unused

Ethernet cards:

NE-2000 clones	(300),320 340,360 340,360	3		(disabled), c8000,cc000, d0000, d4000, d8000, dc000
3Com 3c503/16	250,280,2a0, 2e0,(300), 310,330,350	2,(3), 4,5	(1), 2,3	cc000,dc000, d8000,(c8000), disabled

*By default the Seagate ST01 and ST02 controllers are configured not use any IRQ. You must configure the card to use IRQ 5 by connectings pins F and G on the jumper labelled "EFG."

8.3 Compiled-In Configuration Requirements

The Linux kernel will automatically detect and adapt to the configurations of most of the devices in your computer. However, some of the newer or more obscure device drivers in the kernel do not yet have the ability to detect and adapt to all possible combinations of IO ports, interrupt lines, and DMA channels. Instead some particular setting for these device drivers is chosen

The following chart lists the PC hardware which has to be configured in specific ways in order to be used by the Linux kernel.

The particular configurations have been chosen to match the default settings that the devices have when they are shipped from the factory. The one exception to this rule is the Seagate ST02 IRQ number, where the factory setting is no IRQ but where the kernel requires one.

The "factory defaults" policy has the unfortunate consequence of making it impossible to use certain combinations of hardware without recompiling the kernel. For example, IRQ 5 is used by the STxx/FD-8xx/TMC-950 SCSI controller, the Mitsumi CDROM drive and bus mice. In order to use two or more of these devices in the same machine, you must change the appropriate declarations in the kernel source tree and recompile a new kernel. The last column of the chart identifies the location of the declaration of the interrupt request (IRQ) number.

	IO port	IRQ	DMA	defined in /usr/src/linux/...
SCSI controllers:				
Seagate STxx*/ Future Domain 8xx/ TMC-950		5*		kernel/blk_drv/scsi/seagate.c line 51
Western Digital 7000FASST	350	15	6	kernel/blk_drv/scsi/wd7000.h line 30
Proprietary CDROM interfaces:				
Mitsumi	300	11		include/linux/mcd.h line 25
Sony 535 or Sony 531	340			kernel/blk_drv/sony535.c line 112
Sound cards:				
Adlib/Soundblaster	220	7	1	kernel/chr_drv/sound/local.h

```
                                                          line 15
ProAudioSpectrum-16     388         10      3          same file

Bus mice                            5           include/linux/busmouse.h
                                                          line 29
```

*By default the Seagate ST01 and ST02 controllers are configured not use any IRQ. You must configure the card to use IRQ 5 by connecting pins F and G on the jumper labelled "EFG."

8.4 Forcing Hardware Detection

This section is relevant to you if and only if you have attempted to boot the system and it is not recognizing your Future Domain 8xx, Seagate, or Trantor T-128/128F/228 SCSI controller, or your hard disk, or your ethernet card. For the Trantor controllers, bear in mind that the Trantor SCSI driver is expermintal and is known simply not to work with many hardware configurations. For this reason, the Trantor series is not listed on the hardware compatibility list on the back of the manual.

8.4.1 BIOS-less Controllers

You can skip this section if you are not using a Seagate ST0x, Future Domain TMC-8xx, or Trantor T128 controller. (The Trantor driver is experimental and is known not to work on some systems.) If you are using one of these controllers that has a BIOS ROM on it and if the controller is successfully detected by the default boot procedure, then you also can skip this section. Note that the TMC-8xx and Seagate controllers are 8-bit controllers; if your Future Domain controller is a 16-bit card, then you have a TMC-16xx controller, and you too should skip this section.

There is one situation where you do need to type something to the 'Boot:' prompt in order to load LGX for the first time. When the Linux kernel attempts to detect a SCSI controller that uses the TMC-950 chip, such as the TMC-8xx or the Seagate ST0x, it looks for particular strings in BIOS ROM. If your controller does not have a BIOS ROM, or if it uses a BIOS ROM that does not have one of the strings that Linux expects where Linux expects it, then you need to tell the kernel where your controller is and what interrupt the controller uses. The syntax for providing this information via the boot prompt is as follows (which line you use depends on which controller you have):

```
boot: linux tmc8xx=interrupt,mem_address
boot: linux st0x=interrupt,mem_address
boot: linux t128=interrupt,mem_address
boot: linux ncr5380=port,interrupt,dma_channel
```

For example, to use ROMless TMC-850 controller set to the factory defaults, you would type:

```
boot: cdrom tmc8xx=0xCA000,5
```

8.4.2 Forcing Hard Disk Detection

The following option will force the kernel to recognize the believe that the first IDE, MFM or ESDI disk has the geometry that you specify.

```
boot: cdrom hd=cylinders,heads,sectors
```

8.4.3 Forcing Ethernet Detection

The following option will force the kernel to recognize an ethernet board with the interupt, IO port and memory range that you specify.

```
boot: cdrom ether=interrupt,io_port,mem_start,mem_end,interface-
name
```

interface-name refers to the name of your networking interface. It is the same name that is used by the `route` command. Here are the names used to identify various ethernet cards:

`dl0`	D-Link DL600 ethernet card.
`le0`	AT1500 and NE2100 cards. Some NE2100 cards must be specified for the kernel at boot time.
`eth0`	8390-compatible cards such as the 3com 3c503, Western Digital WD80x3, HPLAN cards, and NE-2000 compatibles.

8.5 Errata

Although your system should run smoothly for the most part, there are, unfortunately, a few known bugs.

1. In order to make the distribution fit on a 680 megabyte CDROM, the bdf source code for the fonts in '`/usr/src/X11/mit/fonts/bdf/*`' have been compressed with `gzip`. You will probably never have occasion to use these files, but if you want to uncompress them files for some reason, use gunzip (e.g., `gunzip bdf/*.gz`).
2. If you have a Microsoft bus mouse, the kernel will think that you also have a Logitech bus mouse and an ATI bus mouse. This bug is harmless.
3. The Always IN-2000 SCSI controller is always detected when the kernel boots, even when the IN-2000 is not there. This bug is harmless.
4. If you have an Ultrastor controller, you must physically reset the machine (e.g., by pressing the `RESET` button or turning the machine off and on) when you reboot, otherwise the Ultrastor will not be detected.

5. Some other hardware combinations also hang on a warm reboot like the Ultrastor. This problem with other hardware combinations appears to be intermittent and may be dependent on having an NE-2000 clone ethernet board installed.
6. The S3 X server may have problems reading the Xconfig files generated by the X configuration script. I say "may" because the board that we picked up for testing the S3 server has turned out not to be an S3 board, and it looks like this manual will have to go to print before we can obtain another board for testing. There are some sample S3 Xconfig files on the floppy disk in /INSTALL/Xconfigs and a couple on the CD (/usr/lib/X11/Xconfig.S3 and /usr/lib/X11/Xconfig.S3.farenheit1280). Try replacing /var/xconfig/Xconfig with any of these files after you have run the X configuration script, which is invoked the first time that you run `xinit`.
7. The S3 X server may not be configured to read compressed fonts, but the fonts on the CDROM are compressed. After you have installed the system on your hard disk, you can uncompress the fonts that you want use (or all of them if you find that simpler). These fonts live in the /usr/lib/X11/fonts/* directories. You will also have to edit the fonts.dir files in these to remove the ".Z" extension from the names of the font files.

8.6 Rebuilding the kernel

If you ever want to rebuild the kernel, here is how to do it.

```
cd /usr/src/linux
make config
make
```

At the `make config` step, you will be prompted with dozens of questions about how you want the kernel configured. Fortunately, these questions have sensible defaults.

The `make` step will eventually create the file /usr/src/linux/zImage, which is the image of a bootable floppy and is also the same type of kernel image in /vmlinux. Whenever you overwrite /vmlinux, be sure to run the shell script '`/etc/lilo/install`' before you reboot, otherwise the new kernel may not be able to boot from your hard disk.

9 Third Party Support

In the proprietary software world, an individual or organization that wants to become a technical support vendor can be impeded by lack of access to source code or essentially taxed through source license fees. In contrast, in the free software world, source access is generally available to anyone, and there are no licensing fees that subordinate one company to another, so support services are likely to be available on a more competitive basis.

If you would like to be listed in the next LGX manual as a third party support vendor for the Yggdrasil CDROM distributions, send a brief synopsis and contact information about your business to:

Yggdrasil Computing, Incorporated
Third Party Support Services
4880 Stevens Creek Blvd., Suite 205
San Jose, California 95129-1034
United States of America
(408)261-6630, fax(408)261-6631
yggdrasil@netcom.com

The following individuals or organizations are offering support services related to the Yggdrasil Linux/GNU/X distribution.

9.1 ACTCOM - Active Communication Ltd.

14 Pinsker Street
Haifa 32715
Israel

Phone: +972-4-326857
Fax: +972-4-231211
Mail: office@actcom.com

Services:

- Unix and communications consultants
- Internet communications services
- CDROM supplier

9.2 Aladdin Enterprises

(name will probably change in the next 2 months)
P.O. box 60264
Palo Alto, CA 94306
voice 415-322-0103
fax 415-322-1734
e-mail ghost@aladdin.com
Contact: L. Peter Deutsch

Background:

Aladdin Enterprises is the developer of Ghostscript and the owner of the Ghostscript copyright.

Services:

- Commercial Ghostscript, including support, upgrades, and alternative licensing.
- Small-scale consulting and contract work in connection with Ghostscript and other PostScript-language-related technology.

9.3 Bitbybit

Kluyverweg 2a
2629 HT Delft
The Netherlands
bitbybit@donau.et.tudelft.nl

Background:

Founded in mid-1992, Bitbybit has a staff of four persons, one with a PhD and two M of Sc. in EE. The average number of persons working at the moment is six.

Services:

Development
Consulting
Installation

Rates:

DFL 75 - DFL 175 per engineering hour

9.4 ClearVu Technical Writing Services

95 Clearview Drive
Christiansburgh, VA 24073
(703) 382-5697

Contact:
Thomas Dunbar
tdunbar@vtaix.cc.vt.edu

Background:
ClearVu is a technical typesetting company that has expanded into building and installing customized Linux-based typesetting systems.

Services:
Customized systems for in-house typesetting of technical materials using Linux together with TeX and miscellaneous special utilities.

Rates:
Hardware prices vary with market.
Installation and technical support: $30 per hour.

9.5 Crynwr Software

11 Grant Street
Potsdam, NY 13676
(315) 268-1925
fax (315) 268-9201

Contact:

Russell Nelson
nelson@crynwr.com

Services:

Creation and support of Linux network drivers.

Background:

Crynwr Software has been selling support for free software since 1991. The particular software is entitled the Crynwr Packet Driver Collection (formerly the Clarkson packet driver collection).

9.6 Free Software Association Of Germany

Heimatring 19
W-6000 Frankfurt/Main 70
Germany
Phone/Fax: ++49-69-6312083
BBS: ++49-69-6312934
fsag@eurom.fsag.incom.de
fsag, 2:247/14 FidoNet

Contact:
Michaela Merz

Services:
Support

Rates:

1 - 8 hours:	DM 150/hour
- 16 hours:	DM 130/hour
- 32 hours:	DM 110/hour
over 32 hours:	DM 90/hour

Free support available for private users and some organizations.

9.7 LEMIS - Lehey Microcomputer Systems

Schellnhausen 2
W-6324 Feldatal
Germany

Phone: 06637/1488
Fax: 06637/1489
Modem: 06637/1553
Mail: lemis%lemis@germany.eu.net

Modem: The system understands V.22 (bis), V.32 (bis), MNP5 and V.42 (bis). Log in as guest, password Guest.

Services:

LEMIS (Lehey Microcomputer Systems) specialises in system-level support for UNIX and similar operating systems. Services include design and installation consulting, ports, software support, electronic mail connectivity and supply of PC hardware and UNIX-based software. Support contracts are available.

9.8 Morse Telecommunications

24 Prospect Avenue
East Rockaway, NY 11518
(516) 887-4046
info@Morse.Net

Morse Telecommunications is pleased to announce The Linux Support Service, an online technical response system designed to assist users new to Linux or Unix in general in getting their systems running without the headaches associated with 'winging it.' Technical support is provided via electronic mail and fax. Direct UUCP connections are provided for sites that want them.

Services:

- Guaranteed twenty-four hour response time to technical queries
- Patches for acknowledged Linux bugs
- Access to our source code and precompiled binary library via electronic mail or fax
- Notification of critical software version updates or bugs
- Dialup UUCP access to our archives

9.9 NeoSoft Corporation

3408 Mangum
Houston, Texas 77092
(713) 684-5969
fax (713) 684-5922

Contact:

Ellyn Mustard
ellyn@neosoft.com

Services:

Custom programming and support for Tcl and Tk.

Rates:

$2500 for a year of commercial support, including 20 hours of consultation, and installation of all new TclX releases during the support period.

Backgrond:

NeoSoft developed and maintains extended tcl (TclX), which is part of the Yggdrasil LGX distribution. The company also sells routers and internet connectivity services in Houston, Texas and St. Louis, Missouri.

9.10 Shallow Water Software

PO Box 410
Simpsonville, MD
(410) 997-8584

Contact:
Peter C. Olsen, P.E.

Services:
consulting, systems configuration, system maintenance, and custom software design for small businesses and professionals.

Rates:
$25 - $125 per engineering hour.
Free or discounted support for schools and non-profit organizations.

Background:
Previous work includes the operations research model used by the Coast Guard to measure the amount of work required to clean up the Exxon Valdez oil spill, a draft National Strategy for Civil Aviation Security done for the Secretary of Transportation, now under review by the FAA, and a Community Development Master Plan for Governors Island, New York, among other projects.

9.11 John B. Thiel

18830 NW Rock Creek Circle #242
Portland, OR 97229
(503) 645-0839
Mail: jbthiel@cse.ogi.edu

Services:

Support, tutoring, design consultation, and custom development on Linux and other free software (device drivers to applications).

Platforms:

Linux, Unix, X-Windows, OS/2, Dos/Windows

Relevant proficiencies:

C, Lisp, i86 asm
Unix system administration
Standard Unix software development tools/methodologies
More or less familiar with wide variety of other languages and interfaces, e.g., SQL, Postcript, Perl, Awk, Rexx, etc.

Background:

Computer Science graduate studies (ongoing)
Electrical Engineering undergraduate
12 years computer experience; Linux since Aug, 1992.

9.12 Virtual World Information Systems

(508) 793-9568

Contact:

Lawrence Foard
lfoard@world.std.com

Services:

- Consulting,
- Device driver development,
- Software porting,
- Application development and customization
- Kernel modifications,
- Custom hardware design, including FPGA, PAL and circuit board manufacturing with in-house facilities.

Rates:

$30-$50 per engineering hour.
Fixed price bids available.

10 Support Services from Yggdrasil

10.1 Free Services

In general, any support that does not require human intervention from Yggdrasil is free. If you log into yggdrasil.com as guest, you can get instructions on how to browse through the current list of trouble reports. We also want to hear about bug reports so that we can fix them in subsequent releases. You can report bugs for free, of course. It is only if you want us to work on your particular bug right now or send you something that we charge you.

On the other hand, if your technical support need is tutorial in nature, then you should use one of our commercial support services listed below. For example, if you want to have somebody talk you through the process of installing your system, setting up an internet connection or partitioning your disk in some unusual way, you should use the consulting hotline.

Yggdrasil offers the following commercial support services:

- Consulting Hotline
- Releases On Demand
- Continuing Support
- General Technical Services
- Development Contracts

10.2 Consulting Hotline

US only: 1-900-446-6075, extension 835 ("TEK"), $2.95 per minute. The 900 number will come online in late July, 1993, initially operating from 11am-noon, and 1pm-4pm pacific time.

You can also call (510) 526-7531 and have this service billed to your credit card or, if you have an established account, directly to your company.

You should use this service if you have a question which is tutorial in nature and you think that it would be a more efficient or more reliable use of your time than "RTFM" ("Reading The Manual"). For example, you might want to use this line if you want if you have a question about a specific emacs command or you want somebody to talk you through the process of installing some new kernel modification that you picked up from net.

10.3 Releases On Demand

For $500, Yggdrasil will fix the LGX problem of your choice and send you a new gold "one off" CDROM with the problem fixed. This service will be available beginning October, 1993.

10.4 Traditional Support

Yggdrasil will fix LGX bugs and implement temporary workarounds as necessary to minimize and hopefully eliminate any downtime due to LGX problems. Traditional Support prices are quoted individually, generally in units of one year, and are loosely based on the following formula:

(machines + contact people + users[including contact people])
X $60/month

10.5 General Technical Services

Is there anything else we can do to help you with your LGX related project? Do you need some documentation written? Perhaps you want a special device driver or a some other new functionality implemented. For these types of miscellaneous projects, you can rent our time for $300 per engineering hour. Everything that we write is covered by either the GNU General Public License or the GNU Library General Public License.

10.6 Development Contracts

Yggdrasil can submit bids for free software development projects, starting at $5,000. Fixed price bids are computed on the basis of $400 per estimated engineering hour.

11 Copyright Acknowledgements

11.1 University of California Copyright

Some of the software in LGX is covered by the following copyright notice:

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11.2 Other Copyrights

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To the best of our knowledge, LGX is now comprised entirely of freely redistributable software and completely obeys all of the copyright requirements of its constituent software components. If you find any instance where we have included unfree software or are not following the copyright requirements of the software, please notify us so that we can remove that software from the next release or observe the requirements of that software as appropriate.

Note that much of the software that comprises LGX, while free, requires that any derivatives works also be freely redistributable. (Simply using LGX to develop a program does not make it a derivative work of software covered by such restrictions. Only incorporating code from such software creates such a derivative.)

12 Reseller List

12.1 Africa

Spartech Pty. Ltd.
10th Floor, Standard Bank House
20 Albert Street
Marshalltown, Johannesburg
South Africa
+27 11 838 3831
fax 27 11 833 1470

ACTCOM
Active Communication Ltd.
14 Pinsker Street
Haifa 32715
Israel
phone: +972 4 326857
fax: +972 4 231211
office@actcom.com

12.2 America

12.2.1 Canada

University of Toronto Bookstore
214 College Street
Toronto, Ontario M5T 3A1
Canada
(416) 978-7900

Zeus Technologies
17 Overlord Street
Whitby, Ontario L1N 8S4
Canada
(416) 666-8309

12.2.2 United States

WEST

Bridgewell Associates
5301 Bethoven Street
Suite 134
Los Angeles, CA 90066
(301) 577-6696
fax (310) 822-6149

Forest Neocom Corporation
10879 San Pablo Avenue
El Cerrito, CA 94530
(510) 234-4362
fax (510) 234-4

Just Computers
PO Box 751414
Petaluma, CA 94975
(707) 769-1648
fax (707) 765-2447

EAST

Austin Code Works
11100 Leafwood Lane
Austin, Texas 78750-3587
(512) 258-0785
fax (512) 258-1342

Mark Horton Associates
PO Box 747
Decatur, GA 30031-0747
(404) 371-0291

InfoMagic, Inc.
Post Office Box 338
Pennington NJ 08534
(609) 683-5501
fax (609) 683-1342

Las Vegas Publishing
3909 South Maryland Parkway
Suite 402
Las Vegas, NV 89109
(702) 795-4838
fax (702) 892-0279

Light Shine USA Inc.
18013 Sky Park Circle, Suite C
Irvine, CA 92714
(714) 553-8401
fax (714) 553-8453

Linux System Laboratories
18300 Tara Drive
Clinton Township, MI 48036
(313) 954-2829

Spheric Microsystems
162 Highway 34, Suite C2-110
Madawan, NJ 07747
(908) 787-4065
email: baller@spheric.com

Pacific HiTech
4530 Fortuna Way
Salt Lake City, UT 84124
(801) 278-2042
fax (801) 278-2666

Quality Computers
2435 Channing Way
Berkeley, CA 94704
(510) 548-2245
fax (510) 548-0442

Promox Systems
1050 East Duane Ave., Suite B
Sunnyvale, CA 94086
(408) 733-2966
fax (408) 733-2968

Walnut Creek CDROM
1547 Palos Verdes Mall #260
Walnut Creek, CA 94596
(510) 674-0783
fax (510) 674-0821

12.3 Asia

TIAWAN

Promox Systems
215-5 Ta-Chiao 3 Street
Yung-Kang City
Taiwan R.O.C.
phone (06) 232-7729
fax (06) 231-2909

JAPAN

CD-ROM shop LASER5
2-62-8-203 Higashi-Ikebukuro
Toshima-ku, Tokyo 170
Japan
phone +81 3-5952-7486
fax +81 45-721-1885

Pacific HiTech
1-18-16 Nomura Building, 10f
Nishishingjuku, Shigjuku
Tokyo 160
Japan
phone +81 3 3345 9215
fax +81 3 3345 9216

Village Center, Inc.
2-2-12 Fujimi-Cho
Choufu City, Tokyo 182
Japan
phone +81 424 88 8428
fax +81 424 88 5471

12.4 Australia

CONTINENT

Systemania
5 Tumut Place
Sylvania Waters
NSW 224
Australia
612 544-7491
fax 612 544-7775

NEW ZEALAND

Shareware Distribution NZ
Freepost 3637 (no stamp required)
PO Box 42-000
Wainuiomata, Wellington
New Zealand
toll free phone/fax 0508 55 66 55
Wellington area: 04 564 5307

12.5 Europe

BRITISH ISLES

Lasermoon Ltd.
2a Beaconsfield Road
Fareham, Hampshire PO16 0QB
United Kingdom
phone +44 329 826444
fax +44 329 825936

Novatec Systems
53 Exiter Road, Selly Oak
Birmingham, B29 6EX
United Kingdom
phone +44 021 456 5759
fax +44 021 455 7472

Takelap Systems Ltd.
The Reddings
Court Robin Lane
Llangwm, USK, Gwent, NP5 1ET
United Kingdom
phone +44 1 2915 357

Frontier Technologies
23B Poppleton Road
Leytonstone, London, E11 1LP
United Kingdom
phone +44 81 989 2450

Ireland On-Line Ltd.
West Wing,
Udaras na Gaeltachta
Furbo, Co. Galway
Ireland
phone +353 (0) 91 92727
fax +353 (0) 91 92726
bbs +353 (0) 91 92722
sales@iol.ie

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Wasaware Oy
Palosaarentie 31
SF-65200 VAASA
Finland
phone +358 61 173365
email hv@uwasa.fi

Kursun CDROM Versand
Karl Marx Ring 148
81737 Munich
Germany
phone +49 89 637 8421
fax +49 89 637 8429

Software News!
Sissacherstr. 57
4052 Basel
Switzerland
phone +41 (61) 313 45 45
fax +41 (61) 313 42 02

Starcom CDROM Versand
Limburggasse 45
A-9073 Klagenfurt
Austria
phone +43 463 23 84 98
fax +43 463 29 67 24

S.u.S.E.: Gesellschaft fur
Software und
Systementwicklung mbH
Erlanger Str. 58
90765 Furth
Germany
phone +49 911 794 0118
fax +49 911 790 6486

13 Direct Sales Order Form

LGX is produced quarterly by Yggdrasil Computing, Incorporated. If you would like a subscription to LGX, please fill out the following page and mail your order to:

Yggdrasil Computing, Incorporated
End User Sales
4880 Stevens Creek, Suite 205
San Jose, California 95129-1034
United States of America

You can also fax your order to (408) 261-6631, or order by telephone, 24 hours a day, 365 days a year, (408) 261-6630, toll free: (800) 261-6630.

13.1 Update Subscriptions

You can use the direct sales order form to order update subscriptions. These subscriptions consist of the CDROM's alone with instructions on installing the update. In order to avoid duplication, update subscriptions begin with the issue after the one that is current when your order is received.

13.2 Motif

The direct sales order form includes a line for ordering Motif for LGX. Please contact us to check availability of Motif before ordering.

```
SHIP TO: ____________________________        YGGDRASIL DIRECT SALES
                                             ORDER FORM
         ____________________________
                                             DAYTIME PHONE: ______________
         ____________________________
                                             EMAIL: ______________________
         ____________________________
        Item                                 Quantity    Price(US$)
LGX (CDROM, 3.5" & 5.25" floppies, manual)   ____   X   $49.95 =  $_______

Update Subscriptions (CD's only, starting with following release):

1 year update subscription (4 releases)      ____   X   $99.95 =  $_______
2 year update subscription (8 releases)      ____   X  $179.95 =  $_______
3 year update subscription (12 releases)     ____   X  $249.95 =  $_______

Promox Motif for LGX (call before ordering)  ____   X  $149.95 =  $_______

Mitsumi LU-005S CDROM drive and controller   ____   X  $199.95 =  $_______

Prime Time Freeware for unix                 ____   X   $59.95 =  $_______

Walnut Creek CDROM's ____________________    ____   X  ______  =  $_______
                        (description)                    (call)
                                                        SUBTOTAL   $_______

    California residents add your county's sales tax (______%)    $_______

                                          Shipping & handling      $_______
                (US: 10% of subtotal, elsewhere: 20% of subtotal)
                                                          TOTAL    $_______

Payment method: __ payment enclosed      __ COD (USA only)
                __ credit card (America Express or Optima.  Call before
                   using VISA, Mastercard or other credit card.)

Your name as it appears on credit card: ____________________________

Brand of credit card: ________  Card number:  ________________________

Signature:____________________________________  Expiration: ___ / ___
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Yggdrasil Linux/GNU/X Operating System
Hardware Compatibility for Fall 1993 Release

System RAM: 4MB (8MB without swap partition), CPU: 386 or above, Bus: ISA, EISA, or localbus.

Disk IDE, RLL, MFM, ESDI, SCSI **with supported SCSI controller.** Configurations range from 2 to 680 megabytes of disk. Configurations without non-kernel source tree that can run without the CDROM range from 27 to 235 megabytes. LGX can share a hard disk with other operating systems on separate partitions.

Tape Drives

SCSI tape **with supported SCSI controller.**

CDROM

- Any SCSI CDROM drive **with supported SCSI controller,**
- Sony 531 or 535,
- Sony CDU-31A, alone or with MediaVision Fusion 16 kit,
- SoundBlaster-compatible CDROM's: Kotobuki, LaserMate, Matsushita, Panasonic, including the CR-562.
- Mitsumi/Genstar, alone or with ATI Stereo FX.

SCSI controllers

Adaptec 1540B, 1542B, 1540C, 1542C, and 1740 in enhanced mode; Always IN-2000, Bustek 542B, Future Domain 8xx, or 16xx, Seagate ST-01/ST02, other controllers based on the TMC-950 chip, Ultrastor 14F, 24F and 34F, Western Digital 7000fasst.

Video cards (for X windows)

640x480 monochrome for all VGA cards. 256 colors up to 1152x900 for non-Diamond cards using the following chipsets: S3, 8514, Tseng Labs ET4000 or ET3000, Paradise, Western Digital 90c00, 90c10 or 90c30, Genoa, ATI VGA Wonder, ATI Mach (e.g., the ATI Ultra Pro), Trident 8900b, 8900c, 8900cl, 8900cs, 9000, Cirrus Logic 5420, 5422 or 5426, NCR 77c22 or 77c22e, or Compaq AVGA.

Sound Adlib, SoundBlaster (regular, Pro and 16 ASP), MediaVision (Fusion and ProAudioSpectrum 16), and ATI Stereo FX. Installable Gravis Ultrasound and MPU-401 drivers are also included. If you do not have a sound card, LGX can play sounds through your PC's speaker.

Ethernet 3Com 3503 and 3c503/16, Artisoft LANtastic AE-2, ATI 1500, Alta Combo, Cabletron, D-Link DE600 pocket adaptor and ethernet II, Hewlett-Packard 27245, 27247, 27250 and PCLAN, Novell NE-1000, NE-2000, and NE-2100, Western Digital 8003 and 8013, other 8390-based ethernet cards.